

Predicting Forex Currency Exchange Rate using Machine Learning

Project Proposal

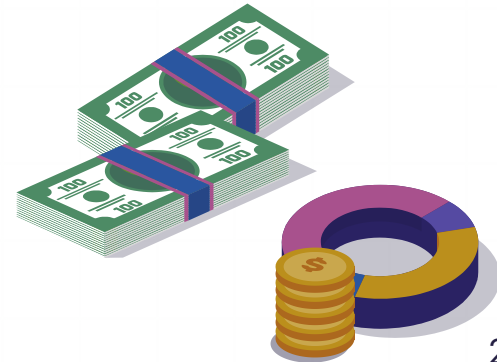
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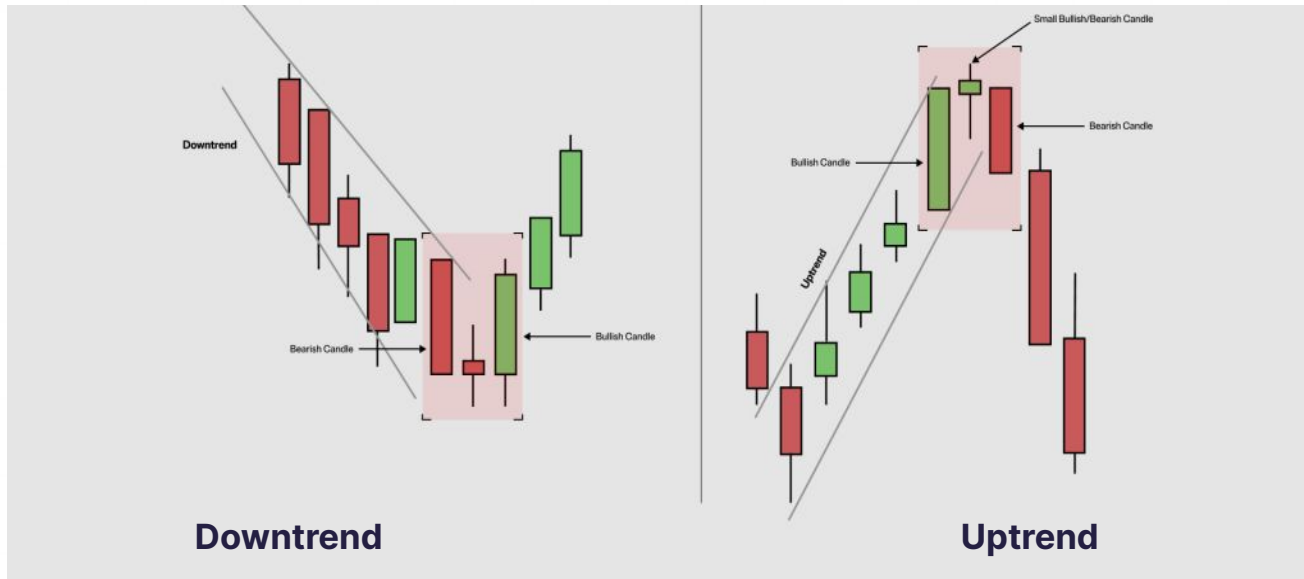
SUPERVISOR

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Introduction

Our Research aims to use Machine Learning techniques to predict currency fluctuation patterns in the forex market over a relatively short period of time.



FOREX Market

- **The forex market/ foreign exchange market**, is a global decentralized marketplace where currencies are traded.
- The largest and most liquid financial market in the world, with a daily trading volume exceeding \$6 trillion
- Trading involves the simultaneous buying of one currency and selling another.
- **Foreign exchange rates** represent the value of one currency in terms of another and determine the exchange ratio between two currencies

Ex : Currency Pairs - EUR/USD : **1.0787** At close: February 9 10:29PM GMT



- Factors Influencing Exchange Rates:

- Interest Rates
- Economic Indicators
- Political Stability
- Market Sentiment
- Trade Balances

All of these factors fall under two main categories:

- **Macroeconomic/fundamental indicators**
- **Technical indicators**



Motivation

Why Exchange Rate Prediction is important ?



- Risk Management
- Cost Reduction
- Strategic Decision Making
- Investment Opportunities
- Forecasting Economic Trends
- Trade Balance Management

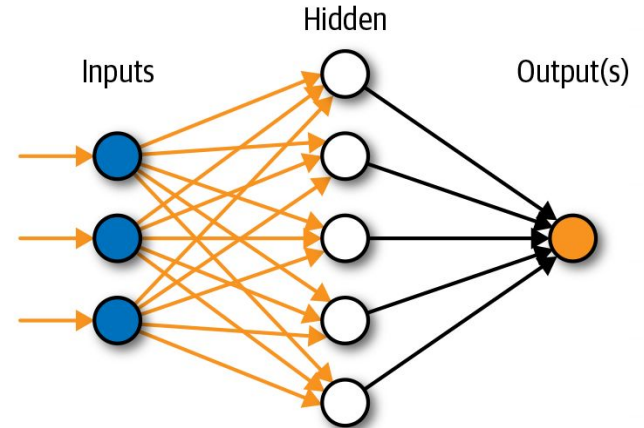


Methodology

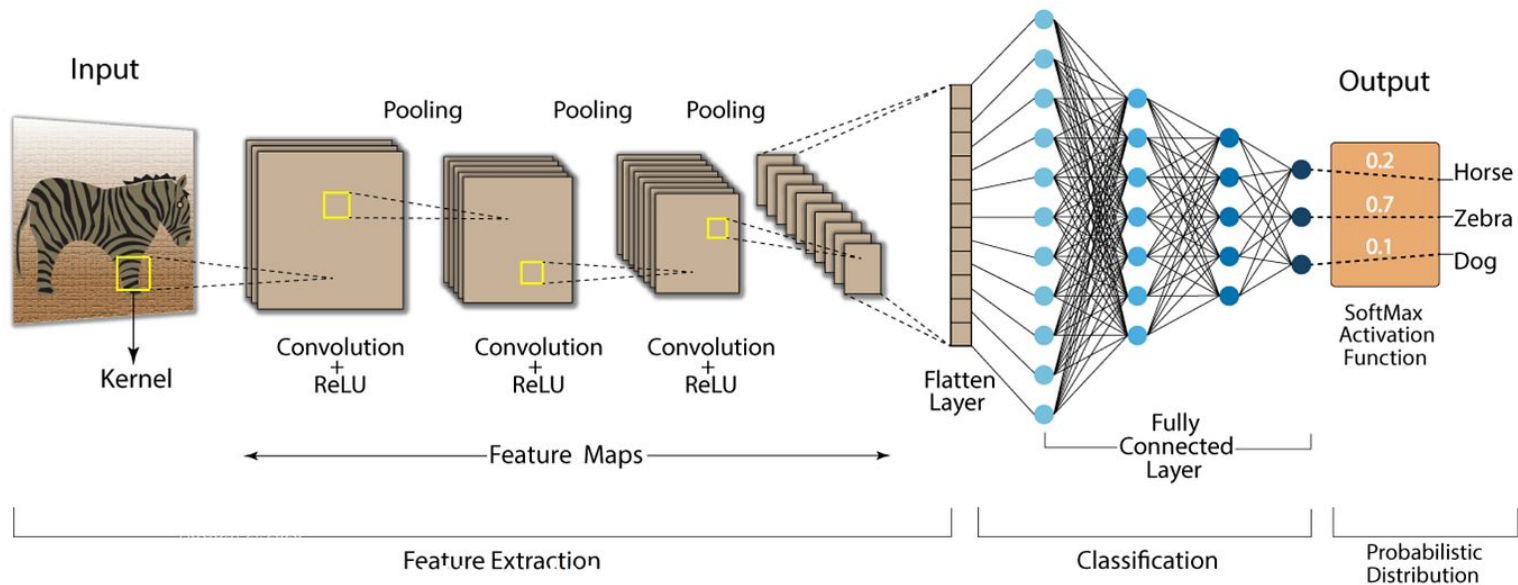
Various models are utilized in methodologies for forex currency exchange rate prediction.

Key Models:

- **Convolutional Neural Networks (CNN)**
- **Recurrent Neural Networks (RNN)**
- **Long Short-Term Memory (LSTM)**



Convolutional Neural Network (CNN)



Example:

Financial Time Series Forecasting – A Deep Learning Approach

Making use of CNNs to forecast the next period price direction with respect to the current price by **Alexiei Dingli and Karl Sant Fournier xie**

Forecasting Model: Develop a CNN-based model using TensorFlow, with adjustments for optimal performance.

- Two convolutional and pooling layers :
 - same padding with stride of 1
 - Max-pooling
 - ReLu activation function

Calculating Accuracy: Argmax function provided by the TensorFlow library

Fine tuning the network by adjusting:

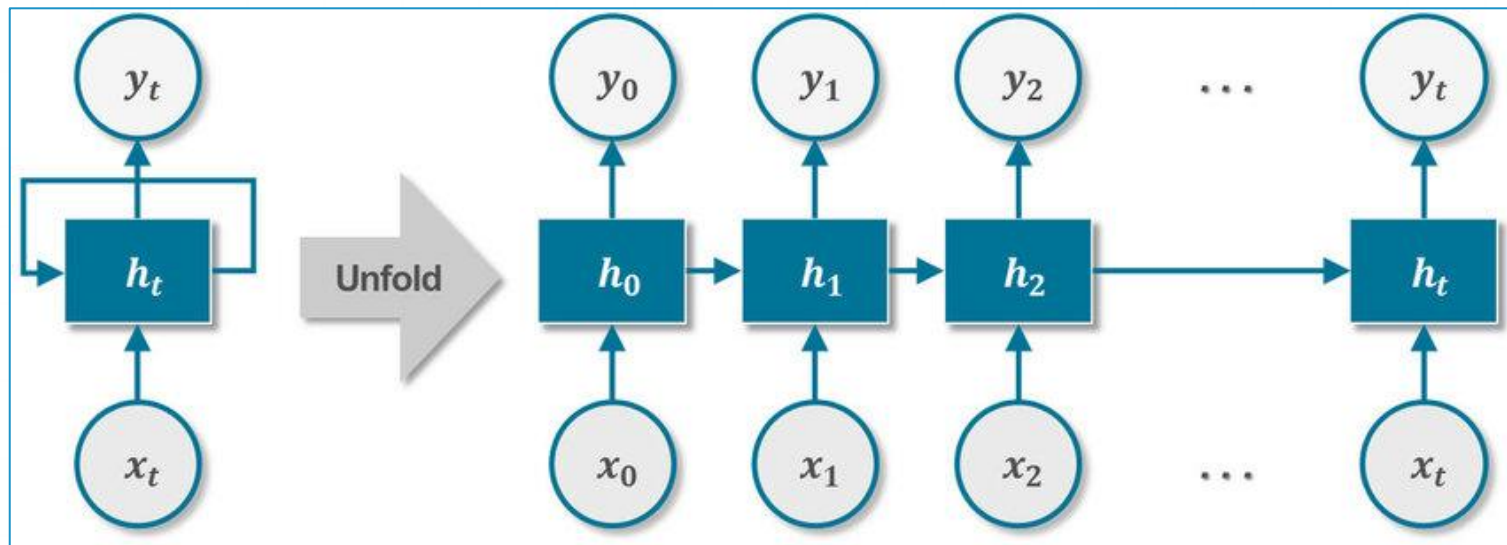
- the depth of the network
- the Learning rate
- the size of the local receptive area
- the number of features for each convolution

TABLE I: OPTIMAL CNN SETUP

Element	Value
Number of Layers	1
Learning Rate	0.001
Dimensions of Receptive Fields	2x2
Feature for each Convolution	256

Achieved an accuracy of **65%** when forecasting the next month price direction and **60%** for the next week price direction forecast.

Recurrent Neural Network (RNN)



RNN architecture

Example:

Using Recurrent Neural Networks To Forecasting of Forex

Trained Recurrent Neural Networks forecast the exchange rates between American Dollar and four other major currencies, Japanese Yen, Swiss Frank, British Pound and EURO.

Data: Taken from www.gelium.net and www.forexite.com

Method: Elman-Jordan neural network has been used. Since it is the recurrent neural net which learns the rules in the time series, this method was successfully used for prediction of financial markets.

Attempts were taken to improve the achieved results in different directions.

- Model with two added technical indicators
- Model with only RSI and %R in input
- Model with RSI, %R and moving average in input
- Model with indicators, returns and exponential moving average

Result:

- The best results have been shown by the network, which had two indicators, moving average and returns in input.
- Replaced moving average by exponential moving average, since it approximates time series more accurate and contains information on longer time period.

Conclusion: statistical estimates of Forex forecast indicates, that neural network can predict the increments sign with relatively high probability – **approximately 80%**, which is quite sufficient for practical use.

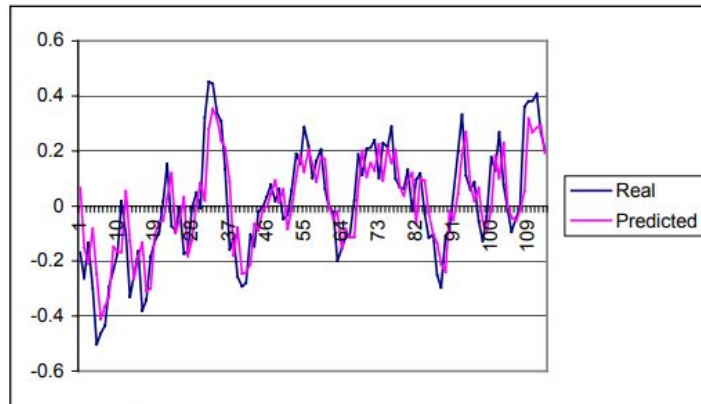
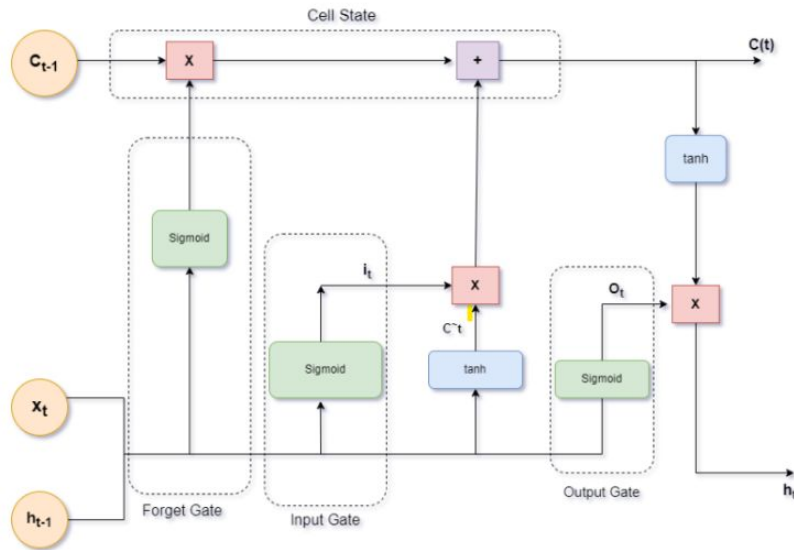


Figure 11. Actual and predicted values of EUR for the period from 12/08/2001 to 04/05/2002.

Long Short-Term Memory (LSTM)



- Cell: The cell stores the state of a sequence, so it has the ability to either keep or forget certain information.
- Input Gate: It decides the extent of information to be stored in the cell.
- Output Gate: It determines what the next hidden state should be.
- Forget Gate: It decides what information should be thrown away or kept.

Example:

Using Long Short-Term Memory To Forecasting of Forex

1. Macroeconomic LSTM model
 - Interest rates of Germany and the EU
 - FED funds rate (for the US)
 - Inflation rates in the EU and the US
 - Close value of the S&P 500 market index
 - Close value of the DAX market index
2. Technical LSTM model
 - Moving Average with a period of 10
 - Moving Average Convergence Divergence with short- and long-term periods of 12 and 26.
 - Rate of Change with a period of 2
 - Momentum with a period of 4
 - RSI with a period of 10
 - BB with period of 20
 - CCI with a period of 20
3. Hybrid LSTM Model

Results:

Table 13 TI_LSTM model: five-days-ahead result summary

From: [Forecasting directional movement of Forex data using LSTM with technical and macroeconomic indicators](#)

	Profit_accuracy (%)	# of transactions
Iterations=50	48.13	187/242
Iterations=100	41.48	176/242
Iterations=150	45.73	164/242
Iterations=200	64.18	79/242
Average	49.88	151.50/242

Table 4 ME_LSTM model: one-day-ahead result summary

From: [Forecasting directional movement of Forex data using LSTM with technical and macroeconomic indicators](#)

	Profit_accuracy (%)	# of transactions
Iterations=50	46.50	243/243
Iterations=100	55.00	60/243
Iterations=150	48.97	243/243
Iterations=200	52.27	52/243
Average	50.69	149.50/243

Results:

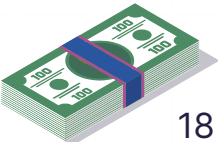
Table 7 Hybrid model: one-day-ahead predictions

From: [Forecasting directional movement of Forex data using LSTM with technical and macroeconomic indicators](#)

Iterations		Hybrid model-modification based on ME_LSTM		Hybrid model-modification based on TI_LSTM	
ME_LSTM	TI_LSTM	Profit_accuracy (%)	# of transactions	Profit_accuracy (%)	# of trans
50	50	70.80	137/243	70.80	137/243
50	100	73.50	117/243	74.36	117/243
50	150	69.60	125/243	77.60	125/243
50	200	81.63	52/243	82.35	52/243
100	50	78.13	32/243	65.63	32/243
100	100	69.23	26/243	65.38	26/243
100	150	70.59	34/243	70.59	34/243
100	200	73.17	46/243	75.00	46/243

Key insights from the research

1. Can major trends in price fluctuations of a currency pair be predicted in advance?
2. Can the start point of that price fluctuation be predicted with acceptable accuracy?
3. Can the end point of that price fluctuation be predicted with acceptable accuracy?



Use of AI Tools

To :

- Extract important points from the complex contents
- Explore new topics and contents
- Spellings and grammar checking



Use of AI Tools

Pros:

- Efficient Content Extraction
- Facilitates Topic Exploration
- Improves Communication
- Accuracy Assurance

Cons:

- Risk of Dependency
- Limited Interpretation
- Potential Inaccuracy
- Privacy and Accessibility Concerns

Demonstration



Data sources and visualization

Alpha Vantage API - financial data provider that offers a wide range of financial data and services primarily targeted at investors, traders, and developers



Demo - Resources

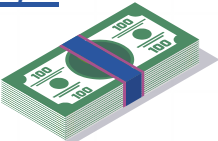
Colab Files

<https://colab.research.google.com/drive/1q-kW3mBJP8HPbWOE-ZIM5EJZJclCS7bL?usp=sharing>

<https://colab.research.google.com/drive/126F2ax3BBxFgVXSlsqjXicLo6jmOX1IC?usp=sharing>

Data File

https://drive.google.com/file/d/1ipsRBqv8aChxObX0liPDapDsxsC_LNdB/view?usp=sharing



Resources

GitHub Repository

[cepdnack/e18-4yp-Predicting-Forex-Currency-Exchange-Rate-using-Machine-Learning](https://github.com/cepdnack/e18-4yp-Predicting-Forex-Currency-Exchange-Rate-using-Machine-Learning)

Project Page

[Projects | Department of Computer Engineering \(cepdnack.github.io\)](https://cepdnack.github.io)



Q&A



Thank You!

